Amendment to Specification (marked version)

Integrated-Shaping Tubes for ~~Energy-saving fluorescent~~an Automatic One-shot-modeled compact fluorescent lamp (CFL) ~~lamp~~ in Mass Production ~~with automatically formed by single step and forming method and the mould of u-shaped tube unit~~ and the Method thereof

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to ~~lighting technology, and more particularly to a~~ compact fluorescent lamps (CFL) tubes, and more particularly, to a~~the~~ method ~~and apparatus~~ for manufacturing ~~the same automatically in one-shot modeling~~an integrated-shaping tube for CFLs in one single processing.

2. Description of Prior Art

~~In accordance with the~~Most conventional compact fluorescent lamps (CFL)~~, the most of them~~ are configured ~~to~~in ~~a columnar~~column-like structure~~, such as~~ (for instance, the U-shaped, n-shaped or H-shaped structure)~~and so on, they are classified to cylinder light source,. but this kind of~~Disadvantages associated with conventional column-like compact fluorescent lamps (CFL) ~~exists some shortcomings~~are listed as follows.~~: one is that~~first of all, ~~the emitted~~ most light emitted from the inside ~~surface~~ of the discharge tube of ~~the~~ a compact fluorescent lamps (CFL) is blocked by ~~the~~its ~~adjacent~~neighboring tubes ~~or~~and ~~opposite discharge~~ tubes around it, so the luminous flux per watt of the compact fluorescent lamps (CFL) is ~~affected~~ significantly reduced; ~~the second~~secondly, ~~is that the~~ since most conventional column-like discharge tubes are ~~arranged~~physically configured in close approximate and hence have little space in between tubes, ~~so close that~~ the heat generated by ~~the discharge~~ tubes can not be ~~radiated~~spread out soon ~~to~~

~~occur the heat quantity collecting to make the working space of the discharge tubes overheat~~, ~~further to~~which also ~~cause~~reduces luminosity factor ~~going down~~ and lifespan of tubes~~shorten~~; thirdly, ~~the third is that the~~ ~~size~~length of ~~the~~ discharge tubes in most conventional CFLs are fixed and cannot be ~~is so big in length~~flexibly adjusted.

~~For resolving~~To solve ~~these~~the above-mentioned ~~problems~~disadvantages, the patent case ZL01253432.3 provided "a ball-shaped compact fluorescent lamps (CFL)", as shown in FIG. 1 and FIG. 2, the lamp includes several discharge tube units 1' connected together by jumpers in bridge linkage, while the ball-shaped compact fluorescent lamps (CFL) is ~~constituted~~comprised of several petal-shaped discharge tubes 1' having a certain curvature radius, ~~such as~~and each leg tube 11' of the discharge tube 1' is arranged on the sphere surface in uniform distribution ~~for obtaining ball-shaped homogeneous light and good distribution curve flux, in this way, the~~. The middle portion of the leg tubes 11' are gradually opened ~~so that the gaps are in consistency and in max~~, as shown in FIG. 3, in radial uniform distribution ~~facilitating~~ to increase the gaps of the leg tubes 11' of the adjacent compact fluorescent lamps (CFL) tubes 1' and ~~a~~the discharge tube unit 1'. In this case, the whole ball compact fluorescent lamps (CFL) tube ~~constituted~~comprises of several discharge tubes 1' having curvature radius (actually being stereo-radian as shown in FIG. 3) has three advantages, ~~comparing~~compared with the prior art, as ~~follows~~listed below: one is that the increased gap between ~~the~~ adjacent compact fluorescent lamps (CFL) discharge tube 1' makes the light ~~given out~~, which emits from inside walls of the discharge tube 1', ~~shoot out passing~~pass through the opposite gaps for ~~obtaining~~ an uniformly distributed ~~ball~~ light source; ~~the next~~secondly, ~~is that the~~ curved leg tubes 11' of the discharge tube 1' ~~appearing to~~of the shape of a ball or an ellipse ~~shape can~~ shortens the length of the discharge tube for ~~obtaining~~ an ~~better~~improved distribution curve flux; ~~the last~~gfinally, ~~is that the~~ increased gaps between ~~the~~

adjacent discharge tubes 1' ~~improves the cooling condition facilitating to reducing~~reduce the temperature ~~of~~ around the lamp~~working space~~ and improves the luminous flux per watt~~, meanwhile the working space temperature of the ballast is reduced too~~, further ~~to improve~~improving the reliability of ~~the~~ ball compact fluorescent lamps (CFL).

~~But, in accordance with the background~~In conventional technology of the art, ~~the target and the actual effect of the invention,~~ the curved leg tube 11' of the discharge tube 1' having a certain stereo-radian and arranged in radial following a sphere, as shown in FIG. 3, is laid out on the sphere surface in uniform distribution for ~~facilitating to obtaining~~a better distribution curve flux and a uniform ball light source~~, but~~. Automatic mass production in manufacturing ~~the~~ leg tubes 11' of the discharge tube 1' having said stereo-radian, and ~~on different position with~~ different curvature radius at different parts of leg tubes 11, however, is difficult to carry out ~~automation scale production, just only by manual, it not only increases the~~, resulting in high production cost ~~with low efficiency, but also the rejection~~; defective rates in manufactured glass tubes also stays high ~~is kept in high level~~. As a result, the above mentioned technique is only limited to ~~On the other hand, this invention just only is used to produce big power~~ compact fluorescent lamps (CFL) (with power above 28 W, and a tube diameter of ~~with~~ 12.~~about~~to ~~-~~18 mm ~~diameter glass tube~~), as commonly seen ~~so far~~ in the market~~, but the smaller power~~. In sum, the above mentioned conventional cannot be applied to compact fluorescent lamps (CFL) (with power ~~lower~~less than 26 W, and a tube diameter ~~with smaller~~less than 12 mm ~~diameter glass tube) is hard to come out~~.

Therefore, the ball-shaped compact fluorescent lamps (CFL) provided by the patent: ZL01253432.3, although, has a high luminous flux per watt, a short-sized discharge tube, ~~the~~a better distribution curve flux of the ball light source, and a ~~good~~ desired effect in cooling

temperature ~~condition features~~, but it is ~~also~~ difficult to put into scale production the invention disclosed in ZL01253432.3 ~~carry out industrial scale production~~, especially for glass tubes of small diameter for CFL lamps ~~in~~ of small power ~~with little diameter glass tube~~. ~~So~~Therefore, ~~its~~ the structure of the patent ZL01253432.3 still needs to be improved~~should be innovated essentially~~.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore a main object of the present invention to provide a compact fluorescent lamps (CFL) discharge tube and a method and apparatus for manufacturing the same, which includes the following advantages:

1) ~~not only remain the~~ high luminous flux per watt,

2) ~~short~~small-sized discharge tube,

3) ~~the better~~improved distribution curve flux of the ball light ~~source, and~~

4) a cooler ambient temperature around the lamp,~~good cooling condition features, but also it can be~~

5) better suited to industrial scale production,

6) tube production made in ~~one-shot~~an integrated-shaping mould ~~modeling~~ with low production cost, high ~~efficiency~~performance ~~and~~or low ~~rejection~~defective rate.

For achieving the above-mentioned object, the present invention provides ~~a one-shot~~an integrated-shaping mould for manufacturing a ~~modeled~~ compact fluorescent lamps (CFL) discharge tube~~, and a whole~~. A compact fluorescent ~~lamps~~lamp (CFL) is typically ~~constituted~~comprised of ~~several~~one or more ~~said~~ discharge tubes, wherein each said discharge tube ~~appears to an~~is an U-~~shaped~~like glass tube with ~~two~~a pair of ~~close~~ parallel leg tubes, and

said ~~both~~ pair of parallel leg tubes are bent to a curve with a ~~certain~~specific curvature radius simultaneously, ~~just as~~like the shape of a right brace ~~appearing to~~")" ~~shape in the side view~~.

The diameter of said pair of leg tubes of the discharge tube is the range of 6. ~~about~~.to 12 mm.

Said discharge tube is bent to an arc, or an arc of an ellipse~~with ellipticity~~.

The number of the discharge tubes is in 2 ~~.about.~~to 5, or more.

~~Several said~~The discharge tubes are ~~integrated~~then assembled into a ~~whole~~ compact fluorescent lamps ~~-~~(CFL), which can be configured to a circle, an ellipse, a rectangle, a triangle or a polygon ~~in top view~~.

The method of manufacturing the same is ~~to follow the below~~include the following processes:

In ~~The~~the first step, ~~put the original~~a straight glass tube is placed onto the conveyer ~~to~~ for moving ~~send~~ into a heater~~, heat the desired portion bending to U-shaped in stage, just as the bending portion is in highest temperature to melting soft, the other portions like the leg tubes are next to the curved segment~~;

In ~~The~~the second step, with the desired portion of the straight glass tube melting in heat and bending to a U-like shape~~bend the thermal-melting glass tube to U-shaped~~;

In ~~The~~the third step, dispose ~~put~~ the bent U-~~shaped~~like glass tube into ~~the modeling~~a pair of integrated-shaping mould, including a cavity die and a male ~~dies~~die;

In ~~The~~the fourth step, ~~by operating with~~a ~~me~~chanical arm controls over the closing-off and opening-up of the pair of integrated-shaping moulds~~, close the cavity die and the male die so that the bent U-glass tube is embedded into the~~to further shape the U-like glass tube to a pre-set ~~U-groove curved in the~~ curvature radius;

In ~~The~~the fifth step, ~~blow up the bending or distorting~~a specific portion of the U-~~glass~~like glass tube is blown at a preset specific range of temperatures ~~so as to fill out the U-groove of the closed die via the straight portion like the leg tube~~for a desired shape;

~~The sixth step~~Finally, ~~by operating with~~ the mechanical arm opens up the pair of integrated-shaping moulds and ~~, open the cavity die and the male die,~~ a finished glass tube ~~can be stripped~~is done.

In said first step, ~~according to~~based on different shapes of the sinuosity of the glass tube, different segments or portions of the U-like glass tube is treated with different temperatures ~~by~~in heating; for example, ~~using different temperature~~ flames at different temperatures heats up different segments or portions of the glass tube~~;~~; or alternatively, ~~or using~~ flame of the same temperature can be used to burn ~~flame treats~~ different segments or portions of the U-like glass tube with time period of different length~~time to get different temperature, also using different temperature flame treats different segment with different time to get different temperature~~. In sum, there are a total of three heating parameters controlling the shape of the final product, i.e. temperatures of hating flame, specific portions of the glass tube being heated, and length of time in heating specific portions of the glass.

In said first step, the glass tube is conveyed to ~~lying~~lie above three wide-section flaming nozzles ~~having~~of different ~~wide~~width ~~just as one or three flaming segments to be heated to melt soft~~.

In said first step, the wide-nozzles are arranged in the sequence of a ~~quadrature.~~first single firing head followed by a second firing head followed in turn by a triple firing head ~~segment.fwdarw.single segment.fwdarw.three segments~~, or alternatively, in the sequence of a first single firing head followed by a triple firing head followed in turn by a single firing

~~head.fwdarw.three.fwdarw.single~~.

The ~~one-shot~~integrated-shaping ~~modeling~~moulds or dies used for automatically manufacturing said U-glass tube is typically comprised of a male die and a cavity die, the die delimiting boundary ~~parting face~~ is formed ~~along~~ with curved axils of the discharge tube so that the U-groove is divided two half-portions respectively formed on the cavity die and the male die ~~along with the die parting face~~, the cross-section of the U-groove on each die appears to be in half a circle.

The radius of the U-groove is in the range of 2.5~~about~~to 6.5 mm, with the preferred value to be in ~~is~~ 4.0~~about~~to 6.0 mm.

The U-groove on the cavity die is kept ~~in~~ smooth, and the bottom side is built upon with an ejector pin with a cone tip ~~for facilitating to~~for stripping.

~~As utilizing above-mentioned project~~To sum up, the present invention has the following ~~follows~~ advantages.~~quadrature.~~ 1. ~~due to~~Since the discharge tube ~~consisted~~comprises of two ~~closing~~neighboring parallel leg tubes ~~with~~of the same curvature radius shaped like a right brace ~~appearing to~~ ")"~~-shape in side view, as increasing~~ the gap between two adjacent tube units significantly increases (more specifically, increase by ~~about more than~~ six times or more of the ~~column wide~~diameter of ~~each~~the tube~~-unit~~), ~~so as to make the~~resulting in more light ~~given~~emitted out from the gap of tubes~~inside wall of the opposite discharge tube pass through the gap to shoot out for improving the~~and hence higher luminous flux per watt;

2. in said compact fluorescent lamps (CFL) discharge tube, each tube unit is consisted of two closing parallel leg tubes with same curvature radius appearing to ")" shape in side view, so the length of the tube unit is shortened comparing to the columnar compact fluorescent lamps

(CFL) tube unit, the whole length of the lamp is shortened so that the structure becomes to compacter;

3. the ~~gap~~ventilation space between ~~the~~ adjacent discharge tubes for compact fluorescent lamps (CFL) ~~discharge tubes~~ is ~~increased~~enlarged, helping to cool down the ~~cooling condition is improved to facilitate to reducing the~~ temperature ~~of the working space~~around the tubes, to increase the durability or life cycle of tubes, and ~~improve~~ to increase the luminous flux per watt~~, meanwhile the working space temperature of the ballast is reduced too, further to improve the reliability of the ball compact fluorescent lamps and the lifespan~~;

4. ~~due to the discharge tube consisted of two closing parallel leg tubes with same curvature radius appearing to ")" shape in side view, just as all the leg tubes of each discharge tube is bent to one direction, instead of the stereo radian~~Unlike the ~~structure of the~~ discharge tubes in the patent ZL01253432.3, in which the leg tubes are bent in different dimensions along with the latitude and longitude of a sphere, ~~so the~~ each leg tube of discharge tubes in ~~provided by~~ the present invention ~~is easy to~~can be easily controlled in mass production ~~processing and more suit to industrial scale production~~to reduce manufacturing cost. ~~Even if the discharge tube is employed of U-shaped glass tube, in~~In manufacturing, ~~the~~a segment or portion of the originally straight glass tube is heated ~~to thermal emit soft firstly in stage segments, and~~to ~~bent~~bend into a U-shape ~~to U-shaped~~, while ~~by means of the straight feature of the glass tube,~~ the pair of the leg tubes of the U-glass tube are configured to be in ~~closing~~ parallel~~,~~; then by means of the integrated-shaping mould~~modeling die~~, the U-glass tube is thus in a single process bent to be a curved discharge tube with the same curvature radius ~~in a single process~~, the ~~both~~two leg tubes of the finished discharge tube ~~are~~remain ~~still kept~~ in close parallel~~, in this way.~~; that is, by means of the pair of integrated-shaping ~~modeling~~moulds or die~~s~~, the very single process ~~modeling~~

~~method can make~~can produce the compact fluorescent lamps (CFL) ~~manufacturing suit to industrial scale production with low production cost, high efficiency and low rejection~~in mass production with a low defective rate.

In one word, compared with prior arts, the glass tubes for CFLs disclosed in the present invention ~~not only~~provides ~~remains the~~a higher luminous flux per watt, a small-sized ~~shorten~~ discharge tube, and a ~~good~~better heat ventilation from the light~~cooling condition features, but also~~; in addition, the method disclosed in the instant application is applied to ~~it can be suit to industrial scale~~mass production in one-shot modeling, especially ~~to producing~~for manufacturing discharge tubes of power less~~maller~~ than 26 W ~~in power~~, and of ~~the~~ diameter ~~of the glass tube~~ in the range of 6 to ~~about.~~12 mm ~~range compact fluorescent lamps (CFL) discharge tube unit, with~~reducing ~~low~~both cost ~~production cost, and high efficiency and low rejection~~defective rates in production.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a scheme showing a tube unit of the patent ZL01253432.3.

FIG. 2 is a scheme of the patent ZL01253432.3.

FIG. 3 is a cross-section view showing B-B section of FIG. 2.

FIG. 4 is a front view showing one discharge tube unit of the present invention.

FIG. 5 is a side view showing one discharge tube unit of the present invention.

FIG. 6 is a topside showing one discharge tube unit of FIG. 4.

FIG. 7 is a front view showing the structure of the present invention.

FIG. 8 is a topside view of FIG. 7.

FIG. 9 is a scheme showing the typical embodiment of the present invention.

FIG. 10 is a topside view showing another embodiment of the present invention.

FIG. 11 is a scheme showing the procedures in manufacturing of the discharge tube of the present invention.

FIG. 12 is a topside view showing the cavity die for manufacturing a discharge tube of the present invention.

FIG. 13 is a cross-section view of FIG. 12.

FIG. 14 is a right-side view showing the cavity die for manufacturing a discharge tube of the present invention.

FIG. 15 is a left-side view showing the cavity die for manufacturing a discharge tube of the present invention.

FIG. 16 is a topside view showing the male die for manufacturing a discharge tube of the present invention.

FIG. 17 is a cross-section view of FIG. 16.

FIG. 18 is a right-side view showing the male die for manufacturing a discharge tube of the present invention.

FIG. 19 is a left-side view showing the male die for manufacturing a discharge tube of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 7 and FIG. 8, a compact fluorescent lamps (CFL) 2 provided by the present invention is typically comprised of four discharge tubes 1 (the number of the discharge tubes is ~~depended~~determined by ~~on~~ the ~~designed~~intended total power) connected together by jumpers in bridge linkage, as shown in FIG. 4 to FIG. 6, while each discharge tube 1 ~~made~~ of a

U-~~shaped~~like glass tube 9 is modeled ~~a~~ with the same curvature radius in one single manufacturing process by ~~means of a~~two ~~modeling~~mould or die ~~101~~ 101and 102~~, cooperating to~~. Referring to FIG. 11, ~~to~~ U-like glass tube 9 of the discharge tube 1 is ~~be~~ configured ~~to~~in a shape like a right brace as ")" ~~shape~~ in its side view, so that the leg tubes 11 of the ~~same~~ discharge tube unit 1 are close to and semi-parallel to each other (as shown in FIG. 4, FIG. 6, FIG. 7 and FIG. 8)~~, in~~. In this embodiment of the present invention, the discharge tube 1 is bent to an arc or an arc ~~with~~of ellipticity (~~non-shown~~not shown in drawings of the instant application).

The diameter of the leg tube 11 of ~~each distribution~~the discharge tube 1 is in the range of 6. ~~about~~to .12 mm.; ~~all the~~ immediately adjacent discharge tubes 1 are connected together by jumpers 3 in bridge linkage, ~~the~~while leg tubes 11 of the first and the last discharge tubes ~~11~~1 are pre-installed with filaments 4 ~~at~~ insides, and ~~all the~~ leg tubes 11 of the discharge tube 1 are coated with earth point triad over the inside wall homogeneously, and filled with proper amount of mercury and inert gas.

~~Referring to~~In the embodiment of FIG. 7 and FIG. 8, ~~in this embodiment,~~ said discharge tubes 1 are configured to a circle arrangement by connecting together with jumpers 3 in bridge linkage to integrate to a compact fluorescent lamps (CFL). ~~Due to the closing parallel leg tube 11 of the discharge tube 1, so, the~~The CFL lamp disclosed in the present invention can be configured to ~~variety shape~~various shapes, depending on ~~the necessary,~~actual needs. ~~as~~As shown in FIG. 10, all discharge tubes 1 together are configured into a ~~to~~ shape of an ellipse by being ~~connecting them together~~connected with jumpers 3 ~~to integrate a compact fluorescent lamps (CFL), in the same way,~~; in a similar way, the discharge tubes 1 ~~also~~ can also be configured into a rectangle, a triangle, or a ~~polygene~~polegon, and so on~~ shapes~~.

Referring to FIG. 9, the integrated tube 2 is mounted on a base 6, wires 5 lead the terminals of the filaments 4 out to the ballast 7, and cords 8 connects the output terminals of the ballast 7 to the base to ~~combine~~assemble a compact fluorescent lamps (CFL).

Referring to FIG. 12 to FIG. 15, and FIG. 16 to FIG. 19, ~~they are respectively shown~~ the cavity die 102 and the male die 101 of the ~~modeling die~~integrated-shaping mould, used for manufacturing U-~~glass~~like tube, ~~one key~~ the operating apparatus of the present invention. The delimiting boundary line between die 102 and die 101parting face (~~just as~~or, in a different term, the contacting ~~face~~surface of the ~~modeling~~mould ~~die~~) of the cavity die 102 and the male die 101 is formed ~~along~~ with curved axils of the desired discharge tube 1 so that the U-groove is divided two half-portions ~~respectively formed~~ on the cavity die 102 and the male die 101 along with the die parting face, while the cross-section of the U-groove on each die appears to half circle, the radius of said U-groove is in 4.0.about.6.0 mm, and the U-groove on the cavity die is built upon with ejector pin with a cone tip at the bottom side for facilitating ~~to~~ stripping.

Referring to FIG. 11, in processing the U-glass discharge tube 1, ~~firstly put the original~~a glass tube 103 is first disposed on the conveyer 104 (other conveyers can be selected also) to be ~~send~~sent into a heater~~, heat;~~ during the process of heating, the desired portion of glass tube 103 ~~bending~~is bent to ~~U-shaped in stage~~a U-like shape, ~~just as the bending portion is in highest temperature to melting soft,~~ while for the other portions ~~like~~of the leg tubes 11 ~~are~~ next to the curved segment~~, said~~. The heater includes wide nozzles 105 connecting to a gas inlet pipe 106, as shown in FIG. 11~~, in~~. Inside the heater, there are three nozzles 105 in different ~~wide~~width, which could be a single firing head or a series of three firing heads ~~individual one segment or three segments shooting flame, in~~, of which the physical locations of these wide-nozzles 105 are arranged in the sequence of a first single-firing head followed by a second single-firing head

followed by a triple-firing head.~~quadrature.single segment.fwdarw.single segment.fwdarw.three segments, of course,~~ or, alternatively, in the sequence of a first single-firing head, followed by a triple-firing head followed by ~~.fwdarw.three.fwdarw.~~a second single-firing head; the gas led by the inlet pipe 106 is shot out respectively from the nozzles 105 to be ignited to form three beams of flame 107 to ~~treat~~soften the glass tube ~~to heat-melting soft~~ in heating ~~process, in operation, according to the~~based on different portions ~~deformed segment~~ of the straight glass tube 103, ~~the parameters of flame~~ differing temperature of heating flame and ~~heating~~ period of time in hearing~~time and so on can be selected so as to heat the different portion into different softness~~, different portions of the glass tube 103 receives different treatment and therefore is shaped differently in the output product~~so the staged heating method is the key of the present invention, in which the different segment of the straight glass tube 103 is treaded with different heating temperature, or different temperature flame, also or with same temperature flame but different heating time, also or with different temperature flame and different heating time, and so on; in addition more,~~ ~~by means of~~ During manufacturing, mechanical arms 110~~, bent~~bend the straight glass tube 103 into a U-~~glass~~like glass tube 9, ~~and by taking the advantages of the stiff feature of the original straight glass tube~~, with the leg tubes 11 of the U-glass tube 9 ~~are kept~~ in parallel; ~~then~~next, ~~plant~~ said U-glass tube 9 is placed ~~into the space~~in between the ~~modeling~~integrated-shaping mould or die 101 and 102; ~~by operating with~~ mechanical arm 108 ~~controlling~~controls the opening or closing ~~open or close~~of the dies 101 and 102,~~, close the~~When cavity die 102 and the male die 101 are closed, ~~so that~~ the bent U-~~glass~~like glass tube 9 is pressed into the U-groove curved in the curvature radius; ~~then blow up~~ the ~~bending or distorting~~curved portion of the U-~~glass~~like glass tube 9 is then blown ~~so as~~ to fill ~~out~~into the U-groove of the closed die 101 and 102~~ via the straight portion like the leg tube 11; by operating with~~when the mechanical arm 108~~,~~

opens up the cavity die 102 ~~and~~from the male die 101, a finished glass discharge tube 1 can be stripped, in which the two leg tube 11 are parallel and close, so the present invention is suit to industrial scale production in one-shot modeling with low production cost, high efficiency and low rejection.

The ~~A~~above-mentioned embodiments of the present invention ~~is just~~are listed ~~only~~ to illustrate the ~~principle~~main idea of the present invention, which can also ~~but not limits it to be used in processing to other~~ be used to manufacturing different shapes of ~~shaped~~ discharge tubes, ~~except for said U-shaped, the discharge tube can be in ,PI- shaped, H-shaped and so on discharge tube~~.